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ABSTRACT

This brief paper describes a project, the Curriculum Development in Teaching Science to Students with Disabilities Project, which provides training to teachers and teacher educators. Participants receive information on teacher education, methods, materials/programs, organizations, media resources, evaluation/assessment alternatives, World Wide Web sites, scientists and engineers with disabilities, management strategies, and service agencies. Disability areas addressed in the workshops include motor/orthopedic impairments, visual impairments, hearing impairments, learning disabilities, attention deficit-hyperactivity disorders, developmental delays, behavior disorders, speech language disorders, autism, deaf/blind, acquired brain injury, other health impairments, and multi-categorical impairments. Five approaches for instructional delivery are covered: (1) explicit teaching, (2) mastery teaching, (3) inquiry teaching, (4) learning cycle or guided discovery, and (5) exploratory learning. The project is being disseminated via pre-conference workshops at major professional meetings and development of support systems for local replication of the project's objectives. (DB)

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CURRICULUM DEVELOPMENT IN TEACHING SCIENCE TO STUDENTS WITH DISABILITIES

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If we are to improve instruction for students with disabilities, and probably for all students, science teachers must be willing to accommodate instruction and adjust the learning environment. Many students receive sub-standard science instruction because teachers and teacher educators are unaware of services and opportunities for students with disabilities in science. All students should be active participants in all facets of the educational program. All students should have the opportunity to achieve success in the learning process. Teachers must become accustomed to teaching fewer concepts with richer insights, to facilitate greater student understanding, and to present opportunities for students to apply what they learned to real-life situations.

Instructors of science methods must model appropriate strategies in their classes and relate the student learning to the educational context in which their students will be teaching. If we are to bring about change in current practice classroom teachers must be able to effectively teach science in inclusive classrooms. Without appropriate modeling by science methods professors, with accompanying experiences in classrooms where students with disabilities are fully integrated, any substantive change is unlikely.

The Curriculum Development in Teaching Science to Students with Disabilities Project provides training to teachers and teacher educators to help them improve their ability to teach science to students with disabilities. The project has enlisted support from several professional organizations, including: National Science Teachers Association (NSTA), American Association for the Advancement of Science (AAAS), Association for the Education of Teachers in Science (AETS), Science Education for Students with Disabilities (SESD), and National Middle School Association (NMSA). The project also extends opportunities to disseminate information from professional organizations and groups, such as experimental projects who have received funding from NSF (i.e. DO-IT, EASI) and agencies committed to specific disabilities.

GOALS AND OBJECTIVES

The primary goal of the project is to prepare a training module for teachers and teacher educators, which improves their knowledge about teaching science to students with disabilities.

Project participants receive information on teacher education, methods, materials/programs, organizations, media resources, evaluation/assessment alternatives, web sites, scientists and engineers with disabilities, management strategies, and service agencies that assist with support for students with

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disabilities. Disability areas addressed in the workshops include: Motor/Orthopedic Impairments, Visual Impairments, Hearing Impairments, Learning Disabilities, Attention Deficit-Hyperactivity Disorders, Developmental Delays, Behavior Disorders, Speech Language Disorders, Autism, Deaf/Blind, Acquired Brain Injury, Other Health Impairments, and Multi-Categorical Impairments.

Participants receive opportunities to experience effective instructional practice for students with disabilities plus guidance and direction for guiding students with disabilities in science learning. They are exposed to five proven alternative approaches to instructional delivery, these are:

1. Explicit Teaching. Explicit teaching is a desirable strategy for convergent instruction. There are basic facts, principles and concepts that are necessary for good science understanding and sound scientific reasoning. The steps included in this approach are helpful in improving the efficiency of instruction when the focus is on dissemination.

2. Mastery Teaching. The seven steps included in mastery teaching are demonstrated using an approach presented in many staff training and administrative training workshops. The strategy is particularly effective in providing learning alternatives for students through skill enhancement activities and small group instruction.

3. Inquiry Teaching. Inquiry teaching is an effective strategy to determine if students have an understanding of a concept. An essential element in the presentation of instruction is the introduction of an unfamiliar task or challenge. The teacher's role is one of serving as a facilitator of learning rather than as a source of knowledge. Teaching through inquiry is valuable in helping students develop conceptual frameworks for problem solving and expanding their abilities to use higher order reasoning.

4. Learning Cycle or Guided Discovery. The 3-phase teaching strategy combines exploration, convergent instruction, and divergent reasoning into a single strategy. It is particularly effective as a strategy when students are lacking in prior experiences. Students engage in hands-on exploratory learning before a concept is introduced and the teacher has an opportunity to check for understanding as students relate what they have learned to real-life situations in the application phase of the strategy.

5. Exploratory Learning. Exploratory learning allows a teacher to serve as a facilitator of student learning in a role where the teacher is not a primary source of knowledge or dispenser of information. The strategy helps students develop confidence in their ability to learn and reason in an environment which is supportive and non-threatening. The approach provides for a high level of interaction among students and is an ideal instructional model for employing cooperative learning strategies.

Objectives:

1. To improve instructional skills and awareness of strategies addressing inclusive science education.

2.To familiarize educators with resources, agencies and services relating to the education of students with disabilities.

3. To expose educators to best practice research and how this research base can be used to better design instruction for all students.

4. To help educators recognize science as a high-interest medium for refocusing math, communication, and problem-solving skills.

5. To demonstrate proven models of instructional delivery used in science.

6. To increase awareness of legal issues about administrative and teaching responsibilities relating to the teaching of science to students with disabilities.

7. To introduce opportunities for electronic communication from the classroom through e-mail and the Internet.

DISSEMINATION

The project has three primary routes of dissemination:

1. Professional development opportunities for science educators and content specialists in higher education through pre-conference programs presented at NSTA, AETS, and NMSA annual conferences, regional workshops for science-teacher special education teacher teams, and exhibit booths at NSTA national conferences.

2. The National Science Teachers Association, the National Middle School Association, and the Association for the Education of Teachers in Science have disseminated announcements to teachers, curriculum directors,administrators and post-secondary educators about the pre-conference workshops through national mailings.

3. Four of the programs have been conducted and participants have been selected for a fifth meeting at NSTA in April, 1998. All of the programs have been filled to capacity by participants.

Objectives

1. Professors in science content and science educators are encouraged to give visible and continuing leadership in providing quality with equity learning opportunities in science for students with disabilities.

2. Those who receive training are expected to plan, organize, and conduct an on-site workshop. The on-site workshop provides information to better serve students with disabilities in science.

3. Individuals at institutions of higher education who are trained in the workshop are expected to revise course syllabi in science methods courses to include elements of teaching science to students with disabilities.

4. Those receiving the workshop training are encouraged to demonstrate self-sustaining, replicable model programs for other disciplines within the university and other institutions of higher education to enhance quality and equity for students with disabilities within higher education.

Professional development for science teacher-special education teacher teams. Participants in the sessions are expected to plan and conduct an on-site workshop. The workshop and resources will provide assistance to administrators, teachers, and parents in their home district on improving services and instruction for students with disabilities.

Objectives

1. Local leadership teams give visible leadership in teaching science for students with disabilities at the local level. Participants develop an action plan for improving the quality of science experiences for students with disabilities in their own school.

2. Local leadership teams are expected to plan, organize, and conduct a local conference at the school or area education site on ways to enhance science teaching for students with disabilities.

3. Local leadership teams are expected to develop a support system of administrators, teachers, parents, and students to support equivalency of instruction in science for students with disabilities.

To disseminate information through an exhibit booth at the National Science Teachers Association Annual Conference. Information is gathered from as many organizations as possible and library searches are conducted in order to gain up-to-date information regarding science and disability education. These materials are distributed to over 3,000 individuals annually.

Objectives

1. To familiarize educators with resources and agencies and services to assist in providing quality exposure in science to students with disabilities.

2. To familiarize educators with best practice research and how this research base can be used to better design instruction for all students.

3. To increase awareness of administrative and teaching responsibilities and actions for quality instruction in science for all students.

4. To introduce educators of opportunities to networking from the classroom to role models and expertise throughout the world.

There appears to be a lack of responsiveness by science teachers to adjust the learning environment so the student with disabilities feels a sense of success and accomplishment. Considerable evidence indicates that the majority of science teachers are not even aware that they can improve students' learning through adaptation and modification of instructional procedures. When asked to describe why students with disabilities have problems learning, teachers report: 1) language skills of reading, writing, following directions, recording data, and verbal expression; 2) concepts and new terminology; and 3) behavior problems. Science teachers expect that others will provide special education assistance, medical assistance, and technical assistance for students.

In higher education the problem is two-fold. Special education professors emphasize services to students who have difficulty in learning, with little attention to learners of average and above average intelligence that have disabilities. At the same time, science methods instructors tend to overlook attention to the learner with disabilities assuming that pedagogy relating to students with special needs are addressed by special education personnel.

The student with disabilities can be expected: 1) to be mainstreamed in science, 2) to be without an advocate for any special accommodations relating to the subject matter content, 3) to experience stereotypical attitudes about concerns of safety in the science laboratory and lowered expectations for achievement.

The project initiatives provide information to educators on responsibilities of contained in legislative mandates, and alert educators to inequities experienced by students with disabilities in the science classroom. Participants experience model lessons and receive information and resources relating to making science instruction responsive to students with disabilities.